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PROGRESS REPORT OF ROADWAY REVEGETATION STUDIES FOR THE MULLAN LINE WEST SECTION OF INTERSTATE I-90 1974-75

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This report describes the principal findings and accomplishments of revegetation studies conducted on sections of I-90 near Mullan, Idaho. The investigative studies were conducted under cooperative agreement between the Intermountain Forest & Range Experiment Station, U.S. Forest Service and the Idaho State Department of Highways. The report summarizes accomplishments and project activities for the 1974-75 period. The principal objectives of the study were to: (1) Select plants that are adapted to roadway disturbances and provide adequate ground cover, but are compatible with the surrounding native vegetation; (2) Develop seedbed preparation and planting practices which would facilitate the planting of inaccessible and harsh road disturbances; (3) Evaluate the environmental and climatic influences which contribute to the establishment and vegetative growth responses of planted stock; and (4) To equate the successional changes to occur in roadway seedings where a mixture of trees, shrubs, forbs, and grasses are seeded together.

This report summarizes the most significant findings and accomplishments attained during the 1974-75 period for each of the above categories. Two major items were of principal concern to this study. The first involves the usefulness of serrated benches, constructed on road cuts to provide a seedbed for direct seedings. The second item of concern is the use of native shrubs and trees planted with grasses and forbs to provide a more diversified array of plants.

Although woody plants are recognized as useful species for range, wildlife, and watershed plantings, few shrubs have been developed or even tested for highway purposes. Difficulties occur in seeding slow-developing shrubs and trees with more aggressive grasses and forbs. However, regulating seeding rates, fertilization, and adjusting seeding dates are practices which can be manipulated to promote the establishment of all plants.

The major portion of I-90 from the Montana-Idaho state line westward to Mullan, Idaho was constructed between 1970 and 1972. Consequently, different portions of the route were open for planting during each of the three years. In addition, three major barrow pits--Osburn, Big Creek, and Elizabeth Park--were benched, seeded, and transplanted with a variety of species. Studies were also established on the barrow sites to evaluate plant responses and planting techniques.

Bimonthly ratings were taken of all new seedings throughout the first growing season. Biannual ratings were recorded the second year as the study sites were inventoried in the early spring and again in the late fall periods. Thereafter, annual ratings were conducted during the peak period of vegetative development. Nearly all studies were established on sites that were contract seeded. However, in 1972, experimental plantings were established by personnel from both cooperating agencies to closely evaluate the interaction of shrubs and trees seeded with selected grasses. Prior to this time, annual seedings and transplanting studies had conclusively shown that woody plants could be established on harsh roadways, but excessive grass competition quickly suppressed the development of most woody plants. Consequently, our efforts have been directed to the development of techniques which would promote the survival and

growth of woody plants when seeded with a herbaceous understory.

OBJECTIVE I

SPECIES SELECTION

Nearly 100 different shrubs, trees, forbs, and grasses have been included in various plantings to select species that are adapted to road disturbances. From first and second year ratings, woods rose, snowbrush ceanothus, and mountain snowberry appear most abundantly. In 1972, seeds of mountain ash and Rockspirea became available and were added to a few planting sites. Both species germinated well and produced abundant seedlings. Both are small seeded and can become easily lodged in small soil fissures. Consequently, the shrubs are well distributed throughout most roadways, even on smooth soil surfaces.

Shrubs which now rate as aggressive developers include blue elderberry, chokecherry, Rockspirea and mountain ash. All shrubs, established by direct seeding, are responsive to fertilizer even as young seedlings. Where adequate rates of fertilizer have been applied, all of the above plants have benefited. Although an increase in seedling establishment has not been reported, the growth rates of 2 and 3 year old shrubs are certainly improved. Shrubs which respond immediately are Rockspirea, mountain ash, and chokecherry. Although other shrubs, particularly blue elderberry, are also responsive to fertilizer; the levels of fertilizers applied did not appear to be an optimum rate. Undoubtedly, fertilizer should be used on harsh sites to promote shrub growth.

Woods rose and snowberry have persisted on adverse rocky sites to the exclusion of other shrubs presently under test. Although both plants appear adapted to infertile soils, neither species has responded very well to fertilization. In contrast, mountain ash and Rockspirea planted on similar sites grow very well if similarly treated. Thus, some shrubs considered sensitive to high levels of fertility can be successfully used on harsh sites if properly managed.

Most trees and shrubs have not attained dominance over the understory vegetation, even though some plantings are now three years old. Where fertilizer has been applied to sites where grasses are less abundant, most shrubs and trees have grown extremely fast. Some plants now are 12-15" in height. The most rapidly growing trees are ponderosa pine and lodgepole pine. Although neither of the two trees is abundant in the native vegetation surrounding the roadway, both species are well adapted to the xeric conditions of the road disturbances.

Both Western larch and grand fir were included in the broadcast seeding. Both are native to surrounding sites and have performed well on the road disturbances. Grand fir germinates readily, and seedlings grow rapidly. First and second year old plants are larger than ponderosa pine or lodgepole pine. However, on most disturbed roadways, neither Grand fir or Western larch is as universally adapted as ponderosa and lodgepole pine.

Unfortunately the small trees that have become established on the long smooth fill slopes are often damaged by the snowpack. Young plants which protrude two feet above the ground level are often deformed and broken as the snowpack creeps or moves downslope. Most multiple stem shrubs are less susceptible to snow damage as growth is not severely restricted if the terminal shoots are damaged. Damage attributable to the shifting snowpack is restricted

to certain sections of the road. Although snow slippage and slumping was expected from some steep cut slopes, this problem has failed to materialize. Problems occur on fill slopes where snow tends to accumulate. Snow that is cleared from the roadway and deposited over the fills cause more damage to the areas immediately aligning the roadway than for most other portions of the fill slopes.

In 1974 most seeded areas were refertilized. Areas not refertilized obviously supported a weaker herbaceous understory. Grass production remained very high for about three years following the first application. A decline in vigor and herbage production was not detected until 1974. Even at this date, the total yield was not seriously reduced. Total ground cover supplied by live plants and litter also remained very high, providing adequate protection to the soil.

As the fertilizer has been depleted from the soil, the composition of the seeded species has changed, favoring plants that are less dependent upon a high level of soil fertility. Although most sites remain dominated by smooth brome, orchard grass, timothy, and intermediate wheatgrass, the density and vigor of Canada bluegrass and white Dutch clover has consistently improved even though the soil fertility has declined. Canada bluegrass has been slow to develop into mature size plants. Numerous seedlings appear immediately after planting, but slowly increased in stature and size. The plants did not appear depressed by competition from other seeded grasses, but are simply slower to mature. The delay in foliage development has not failed to provide an adequate ground cover. In fact, the growth response of this grass should be considered when mixtures of grasses and shrubs are contemplated.

Canada bluegrass is definitely less competitive with seeded shrubs and trees than any other seeded grass. If properly planted, this species has excellent possibilities in seeding mixtures where shrubs and trees are desired.

OBJECTIVE II

SEEDBED PREPARATION

No areas along the roadway or barrow sites which were planted have failed to sustain a vegetative cover. The benching of the cut slopes and the barrow sites has provided an improved seedbed. Although most cut slopes have exposed a rocky substrata, benching has improved conditions for plant establishment and growth. Benched slopes have failed to support plants only in areas where massive, hard rock outcrops occur. This situation prevails in only about ten percent of all the exposed sites.

Benching has created a seedbed that is conclusive to seed germination. Earlier reports have indicated that the number of seeds to germinate on benched slopes was somewhat lower than on seeded fill slopes, but a high number of seedlings emerged at all sites. Most seedling losses on benched slopes normally occurred one or two weeks after the plants emerged. Usually the small seedlings succumb to drought. The rocky bench slopes often contain few soil fines in the mixed rock or rubble; consequently, the water holding capability of these sites is very low. Where soil pockets occur, the plants have survived.

At the present time, the understory grasses seeded on the benched slopes have not developed a vegetative cover that differs from the fill slopes. Most species seeded on the bench sites have persisted. In some benched areas, the grass density has been detrimental to the survival of the seeded shrubs and

trees. In contrast, shrub and tree seedings have been more successful on some benched sites than fill slopes. The woody plants are often established in small pockets isolated from grass competition due to the rough rocky conditions of the planting surface. In addition, the deeper rooted shrubs and trees are better adapted to the rocky soils once the plants become established.

The bench slopes have remained very stable and continue to resist slumping and slope failure. Plants once established on the small mini benches have contributed to the stability of the cut slopes. Few areas have been damaged by excessive slumping.

Although benching has provided both an improved seedbed and a stable cut slope, the benched slopes must still be further treated and managed to sustain a vegetative cover. The exposed parent materials are: A) low in fertility; B) often are rocky and xeric; and C) the side slopes are steep and unstable. Often the bench slopes were poorly seeded. The sites were planted using a hydroseed, which was driven along the roadway. The seed was usually blown upslope onto the benches in a water slurry. Seeds usually were collected on the level benches, and were not well distributed on the side slopes. Fertilizer applied in the seeded slurry was also poorly distributed. However, if properly planted and fertilized, the cut surface can be appreciably improved. The fertility levels must be maintained at a normal rate to maintain a vigorous plant cover.

Although topsoiling is costly and often difficult to accomplish, a small layer of topsoil would be very beneficial on some benched sites. In some areas, natural sloughing has deposited small amounts of topsoil on a few benches. Seedling survival was significantly improved under these circumstances. Other soil ammendments including various types of mulch would undoubtedly be beneficial.

Many large portions of the bench slopes remain bare of vegetation. The lack of seeded plants is not due to the inability of the sites to sustain a plant cover. Usually the areas were not planted. Undoubtedly, improvements in the planting operations must be achieved. Unfortunately, sites left unplanted are slow to become vegetated by natural spread. The surrounding plant communities support few plants that are equally successful on the disturbed slopes as most planted species. Consequently, many areas will remain bare for a considerable period.

Transplanted nursery grown shrubs and trees on the disturbed roadways have continued to persist, and this method of planting provides an excellent method of treating roadways. The survival of transplanted stock reported in 1973 indicated the black locust, Siberian peashrub, and ponderosa pine survived very well two years after planting. No noticeable changes have occurred in transplant survival during 1974. As reported, most transplants which have succumbed, died shortly after planting. Nearly all loss occurred the first year after planting. Plants established on the benched sites require about two years to become well established. During this establishment period, plants of black locust and Siberian peashrub produced some leader growth. Terminal twigs have grown 10-15" each year. However, most ponderosa pine transplants have produced about 3-5" of new growth. Ratings taken in 1974 indicate that most pine transplants require longer periods of establishment before a significant amount of vegetative growth occurs.

Seeded ponderosa pines require 2-3 years to attain significant stature and begin to develop measurable leader growth. Undoubtedly most transplants and seeded shrubs and trees are now old enough to begin to provide a noticeable cover.

Two year old transplants of poplar and willow, planted at the Osburn

barrow site, have made excellent growth. Plants of both shrubs vary in height from 4-6'. Although both species are not adapted to rocky sites, the plants are capable of growing on many portions of the disturbed roadways.

OBJECTIVE III

CLIMATIC INFLUENCES

All climatic stations were maintained throughout the 1974-75 period. Seasonal variations in precipitation and temperature recorded at the Mullan Weather Station have been collected for analysis to determine impacts upon the performance of planted species. Since all plantings are now well established, fluctuations in the amount of precipitation received have not dramatically affected the growth of seeded plants. Nearly all plants grew normally during the summer, although late spring frost defoliated some shrub transplants. Few plants succumbed, but excessive die-back was reported in some locations.

During the period of our studies, plants at the Osburn site have been closely surveyed to detect any damage from air pollution caused by the Kellogg smelter. To date, no appreciable damage has been recorded. Fewer transplants of ponderosa pine have survived at this site than have been recorded at other plantings. However, the differences have been attributed to local soil differences, not air pollutants.

OBJECTIVE IV

PLANT COMPOSITION CHANGES

In 1972, a series of plantings were established on both a fill and benched cut slopes to evaluate the influence of seeding various rates of grasses with a similar mixture of shrub and tree seeds. A principal concern of the revegetation study is to re-establish a permanent canopy of shrubs and trees on the disturbed slopes. The seeded grasses were utilized to furnish an initial ground cover and to stabilize the highly disturbed slopes. Ultimately, the herbaceous understory should improve the fertility of the barren soils and hasten the reinvasion of the native species. Initial changes, undoubtedly, will be slow; but, the introduction of various shrubs and trees by direct seeding could implement a more rapid change.

For first, second and third year ratings, plantings of most shrubs and trees have demonstrated their ability to survive on the harsh environments. The growth of most shrubs and trees could be hastened if the herbaceous understory does not become too competitive. Attempts to regulate the growth of both the grasses and the woody shrubs and trees appear to be successful.

Seeding grasses at a rate of about 2-4 lbs. per acre provides a satisfactory ground cover but has not developed a highly competitive cover. A significant increase in the number of seeded tree and shrub seedlings were recorded on plots where grasses were planted at the above rates.

The application of fertilizer can also be utilized to regulate the plant composition and growth responses of seeded species. Although fertilizer has not been detected to effect seedling survival, young plants certainly benefit from this treatment. Shrubs and trees which are fertilized respond equally as well as do treated grasses.

The growth of shrubs and tree seedlings and young plants should be promoted to develop as rapidly as possible. Small and stunted plants are more likely to succumb than are larger specimens. Also, as trees and shrubs develop in stature, the plants become less susceptible to the understory herbs, and ultimately attain dominance over the site. Fertilizing plots where grasses and shrubs occur in proper balance has not been detrimental to either group of plants.

Conditions at all planting sites have continued to improve. The use of seeded and transplanted shrubs and trees has been successful, and has improved the vegetative cover. Major improvements in road revegetation can be developed from information gathered at this site.

Considerable information has been obtained through this study. Portions of a paper entitled "Plant Selection for Erosion Control on Forest Roads of the Idaho Batholith" were developed from information derived from this study site. (Appendix I).

MULLEN - REVEGETATION STUDIES

Nearly 100 different shrubs, trees, forbs and grasses were planted on benched and tilled slopes.

At this point in the conduct of the project, some conclusions are as follows:

1. Woods rose, snowbrush ceanothus and mtn. snowberry appeared most abundant of the shrubs.

2. Aggressive developing shrubs were blue elderberry, choke cherry, rockspirea and mtn. ash.

3. Rockspirea, mtn. ash and choke cherry responded immediately to re-fertilization.

4. Woods rose and snowberry have persisted on adverse rocky sites to the exclusion of other shrubs.

5. The most rapidly growing trees are ponderosa pine and lodgepole.

6. Most multiple stem species are less susceptible to snow damage.

7. The density and vigor of Canada bluegrass and white Dutch clover consistently improved even though soil fertility declined.

8. Canada bluegrass has excellent possibilities in mixtures where shrubs and trees are also desired.

9. Although most cut slopes have exposed a rocky substrata, benching has improved conditions for plant establishment and growth. Only where there are massive rock outcrops have the benches failed to support vegetation.

10. The bench slopes have remained very stable and continue to resist slumping and slope failure. Few areas have been damaged by excessive slumping.

11. Natural deposition of small amounts of topsoil on the benches significantly improved seedling survival.

12. Portions of the bench slopes remain bare of vegetation because the areas were not planted. Improvement in planting operations are needed.